Large Vehicle Landing Surface Interaction (Lpad-ACO)

Plume Surface Interaction: Cratering and Ejecta

- Safely land and launch a SpaceX Starship with ~2.2 MN of thrust on the Moon (100 MT payload)
- Advance engine plume models to assess plume interaction with Lunar regolith and determine needed Starship design & landing method changes. (Starship is the second stage and lander of SpaceX's Starship-Super Heavy launch vehicle.)
- Test methods for building landing pads using in-situ resource to mitigate Starship landing risk and expand available landing sites.

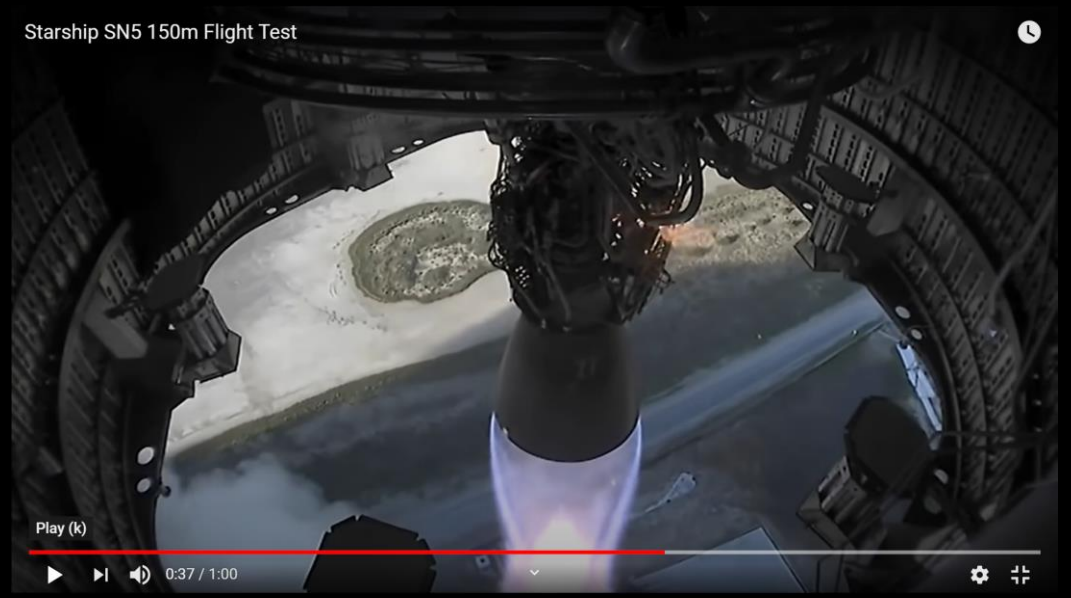
Technical Approach

Phase I: Apply existing computer software methods for rarefied gas dynamics, particle trajectories and heat transfer to model Raptor engine plume using actual test data. Create scaled test cases to inform models. Perform cold gas testing in the GMRO Regolith Test Bed.

Phase 2: Perform hot fire (LO_2/CH_4) test to anchor the assumptions implicit to the modeling and prove landing /launch pad materials viability.

Results/Summary

- Granular Gas Flow Solver (GGFS) code used to assess the cratering and ejecta characteristics of various Starship lunar landing ConOps.
- Trade Study of landing pad materials for mitigation completed and test coupons being developed for a hot fire test by Masten in Mojave, CA.



Raptor Engine on SN5 Starship Test